REMARKS

Claims 63-67 are pending in the present application. Claims 63-67 have been added. Claims 33-62 have been canceled. Claims 1-32 were canceled previously. The specification has been amended to restore the written description to its state prior to the filing of the first RCE.

Applicant thanks the Examiner for the Examiner Interview conducted on July 19, 2004, and respectfully requests reconsideration of the application in view of the foregoing amendments and the remarks appearing below.

Interview Summary

On July 19, 2004, a telephonic Examiner Interview was conducted with the Examiner, Applicant's representative/inventor Javier Valenzuela, and Applicant's attorneys Lawrence Meier and Morgan Heller participating. During the Interview, various aspects of the invention as shown in the drawings and described in the written specification were discussed, as was terminology appearing in the claims. Although no agreement was reached between the Examiner and the other participants, the Examiner indicated that she now has a clearer understanding of the various aspects of the invention and the attorneys indicated that they have a better understanding of issues the Examiner has identified relative to claim terminology.

Objection to Amendments

The Examiner has objected to the amendments filed on July 28; 2003 and on October 29, 2003 under 35 U.S.C. § 132 as introducing new matter.

Applicant has canceled all of the claims amended in these amendments, has deleted the portions of the specification previously added to address alternative terminology, and has withdrawn the proposal for amending the drawings (see below). Consequently, the present objection is moot. Therefore, Applicant respectfully requests that the Examiner withdraw this objection.

Oath/Declaration

The Examiner indicated that the above-mentioned prior amendments present subject matter not originally claimed or embraced by the invention and that, for this reason, a new oath/declaration must be submitted.

Applicant has canceled all of the claims amended in the prior amendments. Consequently, the issue regarding the new oath/declaration is moot.

Disapproval of Drawings

The Examiner has disapproved the amended drawings filed with the amendment dated October 29, 2003 as containing new matter and not being in proper format.

Applicant hereby withdraws the drawing amendments proposed in the October 29, 2003 Response. Consequently, the present disapproval is moot. Therefore, Applicant respectfully requests that the Examiner withdraw the present disapproval.

Rejections Under 35 U.S.C. § 112

The Examiner has rejected claims 41-62 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement, asserting that the originally filed disclosure does not mention, disclose, or otherwise support the recitation of any impervious heat transfer layers or permeable heat transfer matrices as being part of the present invention.

Applicant has canceled claims 41-62. Consequently, the present disapproval is moot. Therefore, Applicant respectfully requests that the Examiner withdraw the present rejection.

The Examiner has rejected claims 41-62 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as the invention, stating, among other things, that the terms "impervious" and "permeable" are relative and are not defined by the claims.

Applicant has canceled claims 41-62. Consequently, the present disapproval is moot. Therefore, Applicant respectfully requests that the Examiner withdraw the present rejection.

Rejections Under 35 U.S.C. § 102(b)

The Nguyen Patent

The Examiner has rejected claims 36, 39, and 40 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,016,707 to Nguyen, asserting Nguyen discloses a structure and method each containing all the elements of the corresponding claims.

Applicant has canceled claims 36, 39 and 40. Consequently, the present rejection is moot. Therefore, Applicant respectfully requests that the Examiner withdraw the present rejection.

The Chu et al. Patent

The Examiner has rejected claims 33-40 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,269,372 to Chu et al., asserting Chu et al. disclose a structure and method each containing all the elements of the corresponding claims.

Applicant has canceled claims 33-40. Consequently, the present rejection is moot. Therefore, Applicant respectfully requests that the Examiner withdraw the present rejection.

New Claims 63-67

The Present Invention and Its Development

Prior to describing how new claims 63-67 define over the prior art, including the Chu et al. and Nguyen patents cited in past and present Office Actions, Applicant takes this opportunity to describe the normal flow concepts to which the present application is directed. The Examiner is encouraged to read Exhibit A, which is an excerpt from a white paper entitled "Cooling High Heat Flux Devices with *Mikros* Microchannel Heat Sinks," co-authored by the present inventor. This excerpt describes the basic concept of normal flow heat sinks in which heat is transferred from the heat sink to the fluid flowing therein primarily as the fluid flows in a direction normal to the heat transfer surface. This excerpt states that the normal flow heat transfer concept was first patented in 1991 by the present inventor.

As just mentioned, the broad normal flow heat transfer concept is based upon directing the fluid within the heat sink through a heat transfer matrix, or heat transfer structure, in a direction normal to the heat transfer surface so that the fluid acquires heat from the heat transfer structure. In the earlier work by Applicant, illustrated in U.S. Patent No. 5,029,638 (attached as Exhibit B for convenience of the Examiner), normal flow was achieved by having an inlet plenum spaced from the heat transfer interface and a plurality of outlet conduits located immediately adjacent the heat transfer interface. A heat transfer matrix comprising, e.g., a porous material or parallel spaced plates, was present between the inlet plenum and the heat transfer interface. Good thermal communication existed between the heat transfer matrix and the heat transfer interface wherever possible, i.e., where the outlet conduits were not present. Fluid from the inlet plenum flowed through the heat transfer matrix in a direction substantially normal to the heat transfer interface to a location adjacent the heat transfer interface where the outlet

conduits collected the heated fluid and moved it out of the core. The fluid acquired the majority of its heat from the heat exchanger during its passage through the heat transfer matrix.

While the earlier normal flow heat sink provided substantial improvements in performance over parallel flow heat exchangers, the presence of the outlet conduits adjacent the heat transfer surface introduced an additional heat transfer resistance. In order to promote normal flow, the outlet conduits had to occupy approximately half of the heat transfer interface, thereby reducing the amount of thermally conductive material connecting the heat transfer matrix to the heat transfer interface. Moreover, in an attempt to reduce the additional thermal resistance introduced by the outlet conduits, the conduits were made relatively small, thereby increasing the pressure drop in the heat exchanger. This increase in pressure drop in the outlet conduits was compounded because it required that the heat transfer matrix be made thicker than dictated by heat transfer considerations, in order to ensure a uniform flow distribution over the heat transfer surface. In the end, flow mal-distribution limited the maximum size of the heat transfer surface that could be effectively cooled using a normal flow heat exchanger.

The present invention was conceived based on a desire to address these drawbacks of earlier normal flow heat sinks. As can be readily seen throughout the present application, a solution to the problems arising from having the outlet conduits adjacent the heat transfer interface is to locate the outlet conduits away from the heat transfer interface, e.g., in the region of the inlet plenum. In the present invention, the former inlet plenum is divided into a plurality of alternating inlet and outlet passages and a plurality of outflow regions are created in the heat transfer matrix to collect the fluid at a location proximate the heat transfer interface and covey it to the corresponding outlet channels. These outflow regions, in combinations with the outlet passages, now replace the former outlet conduits. The remaining heat transfer matrix is separated from this outflow regions by internal walls that are normal to the heat transfer interface and leave an open space at the boundary between the heat transfer matrix and the heat transfer interface for the fluid to exit the heat transfer matrix. The pressure drop in these outflow regions is much smaller than in the former outflow conduits because the flow area is larger and the flow length shorter. This means that the outflow regions can occupy a much smaller fraction of the heat transfer interface than did the former outflow conduits. Hence, both the heat transfer resistance and the pressure drop are reduced by the improvements of the present invention.

Moreover, the present invention eliminates the prior size limitation on the normal flow heat exchanger.

The overarching novel "normal flow" fluid flow path within the heat exchanger of the present invention is consistent across the various embodiments shown. Although the present application is directed largely to a preferred embodiment of the present invention in which the heat exchanger is made of a plurality of plates stacked and bonded with one another along a stacking axis parallel to the inlet and outlet manifolds, a careful reading of the present application clearly demonstrates that the flow path within the heat exchanger, and not necessarily the construction of the heat exchanger, is a primary aspect of the present iuvention. For example, paragraph [0016] of the originally filed application states that alternative heat exchangers of the present invention may be made using plates stacked in a direction perpendicular to the inlet and outlet manifolds. This results in a much different construction than the construction depicted in the drawings.

However, the normal flow paths remain the same regardless of how the heat exchanger is constructed. Those skilled in the art would readily recognize that the plate construction shown is one way to construct a heat exchanger of the present invention but is certainly not the only way. Particularly in the mechanical arts, the law permits applicants to claim their inventions broadly even though they choose to disclose only one embodiment. This is so because inventions, such as the present invention, that are primarily mechanical in nature are based on concepts that are highly predictable. Thus, to disclose one embodiment is to disclose the broad concept embodied therein. Consequently, the law permits these broad concepts to be protected by correspondingly broad claims.

The New Claims and Prior Art of Record

Applicant asserts that each of new independent claims 63, and 65 recites an invention not disclosed or suggested by the references of record alone or in combination with one another and/or with ordinary skill in the art. In order to illustrate this assertion, Applicant compares below these independent claims to each of the Chu et al. and Nguyen et al. patents discussed at length in prior communications from the Applicant, including the Preliminary Amendment of July 28, 2003. Therefore, each of these patents is not described in detail herein.

Regarding the Chu et al. patent, each of new independent claims 63 and 65 require among other things a plurality of internal walls that separate immediately adjacent pairs of

inflow and outflow portions and that extend to locations proximate the heat transfer surface. These internal walls provide lateral boundaries to the channels in the heat transfer structure in the inflow regions and cause the flow within the heat transfer structure to be in a direction normal to the heat transfer surface. Chu et al. do not disclose or suggest such walls or partitions. A result of this is that the flow within the Chu et al. device is parallel to the heat transfer interface in the region were most of the heat transfer between the fluid and the heat sink is taking place, namely the kerfs 14 or 214. This parallel flow requirement is clearly stated in claim 1 of the Chu et al. patent. This parallel flow direction is different from the normal flow necessitated by the structure of the present invention.

Regarding the Nguyen patent, Nguyen discloses a device that includes a heat transfer interface (a plane separating the two sides of the fluid-to-fluid heat exchanger) and a manifold region (the end region formed by plates 10, 11 and 12). However, the Nguyen manifold region is perpendicular to the heat transfer interface rather than coextensive with the heat transfer interface as required by new independent claims 63 and 65. In addition, the partition separating the inlet and outlet passages (11a) does not extend into the heat transfer matrix as required by new claims 63 and 65.

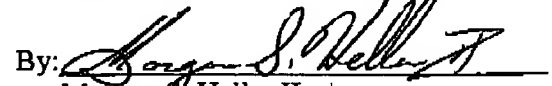
Applicant asserts that new dependent claims 64, 66 and 67 likewise contain limitations that define over the references of record, including the Chu et al. and Nguyen patents.

CONCLUSION

In view of the foregoing, Applicant submits that new claims 63-67 are in condition for allowance. Therefore, prompt issuance of a Notice of Allowance is respectfully solicited. If any issues remain, the Examiner is encouraged to call the undersigned attorney at the number listed below.

Respectfully submitted,

MIKROS MANUFACTURING, INC.

By: 
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Attachments:

Exhibit A: Excerpt from "Cooling High Heat Flux Devices with *Mikros* Microchannel Heat Sinks"

Exhibit B: U.S. Patent No. 5.029,683

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